Economic Feasibility of Small Scale Vegetable Production and Retailing in Rural Communities

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Abstract

Economic information about the feasibility of producing and retailing vegetables in rural communities is limited. The objectives were to determine actual net return from producing and retailing a mix of produce in a rural community, and to determine if consumers were willing to pay differentiated prices for the locally-grown vegetables.

Introduction

Currently, the bulk of our nation's produce is produced in specific growing regions in California, Florida, Washington, Idaho and Arizona where certain comparative economic advantages exists, including growing conditions, labor markets, processing facilities and operating capital (NASS). In addition, a large percentage of our nation's produce is imported during the off-production season from Latin American countries such as Mexico and Chile who have similar comparative advantages in production. As a result of these comparative advantages, farms producing in these regions often exhibit constant returns to scale. However, many research studies show that consumer demand for higher quality, locally grown fruits and vegetables have increased substantially (AMS-USDA; Wolf, Spittler, and Ahern; Estes; and Eastwood, Brooker, and Gray). For the most part, this increase in preference has been driven by increases in household income and exposure to higher levels of education. This rise in demand has been most noticeable in the urban communities with the development of numerous economically successful fresh produce markets.

At the same time the nation has been realizing increases in preference for locally grown produce, a myriad of health awareness organizations working closely with state and local governments and school administrators are stepping up their battle against the national child obesity crisis with the creation of many national and state farm-to-school programs. These programs seek to educate children about food nutrition and to better inform children about where and how food is produced. An additional goal of the programs is to infuse locally grown vegetables into schools in an attempt to provide students with meals that include a better selection of high quality fruits and vegetables. Some have hypothesized that these “farm to school” programs will further stimulate demand for locally grown fruits and vegetables. With this anticipated expansion in demand for locally grown produce, many producers in the rural agrarian regions of the United States are interested in knowing if they have additional opportunity to supplement their farm income by producing and retailing fresh produce.

A better question for these producers to ask would be: is there opportunity to engage in economically viable small-scale fruit and vegetable production and retailing enterprises? Identifying answers to this question better serves the majority of producers as most of them lack the comparative (economic) advantages necessary for large scale efficient production of most types of produce, especially those that are labor intensive and perish quickly. Much of the research regarding locally grown produce has focused on urban demand, including numerous willingness-to-pay studies that seek to determine the premiums that consumers are willing to pay for locally grown produce (Darby et al.; Loureiro and Hine; Govindasamy and Italia; and Yen et al.). However, little research focuses on the connection between cost of production and willingness-to-pay for locally grown produce by rural consumers.

In response to these issues, the Noble Foundation (a non-profit agricultural research institution located in south-central Oklahoma) established a small-scale, fresh produce production and retailing pilot program in 2006. The program, known as the Noble Produce Garden and Market (NPGM), was designed to engage in the small scale production and on-site retailing of a mix of fresh vegetables, fruits, and various flowers to citizens living in or near the rural community of Ardmore, which is located in south-central Oklahoma. The objectives of the project were to determine the actual costs and net returns of producing the mix of fruits, vegetables, and flowers and to determine if consumers in this rural community were willing to pay a differentiated price above the price charged by local supermarket chains. Production information gathered in the project would be useful to producers that are interested in growing produce. Retailing information would be useful to local producers and marketers in that it would help them make better decisions regarding the best way to utilize their marketing resources. This information would also be useful to state and local food procurement officials in helping them determine how much they will have to pay producers for locally grown produce for rural schools.

In the next section of the paper we provide a description of activities of the garden project, including production activities and technologies, and the retailing operation. We then report our findings of both the production and retailing activities, and comment on their implications for farm producers and policy makers. Lastly, we provide concluding remarks and discuss our plans for future research.

Crop Mix and Production Technologies

In the spring of 2006, horticulturalists initiated production activities for 24 various types of fresh vegetables, fruits and assorted flowers. Production activity for each crop type was divided into four primary stages of production, including preplant, planting, harvesting, and cleanup stages. Vegetables produced included eight varieties of pepper, including [green bell, Italian long, banana, jalapeño, Anaheim, pablano (Capsicum annuum)], and red and yellow habanera (Capsicum chinense); three varieties of squash, including [yellow squash, gold zucchini squash, and green zucchini squash (Cucurbita pepo)]; eggplant (Solanum melongena); snap bean

(Phaseolus vulgaris); southern pea (Vigna unguiculata); cucumber (Cucumis sativus); sweet corn (Zea mays); and okra (Abelmoschus esculentus). Fruit enterprises included seeded and seedless watermelon (Citrullus lanatus), cantaloupe (Cucumis melo), and field tomato (Lycopersicon esculentum). Lastly, three types of cut flowers were produced, including gladiola (Gladiolus grandiflorus), sunflower (Helianthus annuus), and zinnia (Zinnia elegans). The mix of produce was chosen based on their suitability for the region's growing conditions, and their expected demand by local consumers.

A breakdown of each crop, soil type, acreage, production technology, plant and row spacing, and planting methods are reported in Table 2. All production occurred on one of two properties owned by the Noble Foundation. The Dupy Research Farm (DRF), located approximately 10 miles northeast of the south-central Oklahoma community of Ardmore, was used to produce all summer squash, okra, sweet corn, cantaloupe, southern pea, and snap bean. Soil preparation for these enterprises was performed on a Dale silt loam soil using conventional tillage practices. Crops produced at the DRF were produced using conventional tillage practices (CTP) and irrigated using an overhead linear irrigation system. Irrigation needs were determined using a "feel and appearance method" (NRCS-USDA).

All other produce was produced at the Headquarters Research Farm (HRS), located on the eastern boundary of the community of Ardmore. Each variety of pepper, eggplant and field tomato were produced using conventional tillage practices and non-permanent raised growing beds with plastic mulch (RBPM) in a Weatherford fine sandy loam soil. Both seeded and seedless watermelon enterprises were also produced on a Wilson silt loam soil using conventional tillage methods and non-permanent raised growing beds with plastic mulch

(RBPM). Cucumber, zinnia, and sunflower were produced outside in permanent raised growing beds (PRGB) in a loam soil amended with peat moss.

Hoop houses have been shown to be a useful technology for early season production and season extension of certain horticultural crops (Lamont et al.; Wells 1996; Wells 2000; Wells and Loy). As a result, early season production of field tomato, yellow squash, cucumber, and zinnia were grown in hoop houses equipped with permanent growing beds (HHPB). Similar to the PRGB technology, the HHPB technology utilized a loam soil amended with peat moss. All crops grown at the HRF (including crops grown using HHPB technology) were irrigated using a drip type system. Irrigation was initiated when a soil water tension reading of between 30 and 40 centibars (approximately 50% of available water depletion) was indicated using a tensiometer. Irrigation was terminated when the soil moisture level reached filed capacity as indicated by the tensiometer.

Although a direct comparison of costs and returns of crop enterprises, including crops grown using the HHPB technology, could not be made due to differences in scale of production, the actual costs and returns were computed as separate activities.

Initial starting dates for preplant, planting, harvest, and cleanup stages of production are reported in Table 2. Due to excessive rainfall and weed problems, several preplant activities had to be repeated prior to planting. In addition, several crops such as field tomato and sweet corn required several planting dates to ensure a continual supply of product throughout the summer. As indicated, production activities for the project started in the first week of March and lasted through the latter part of August, accounting for approximately 6 full months of production.

A total of 9 full time summer workers (high school students) were utilized throughout the four stages of production. College interns were utilized to retail the produce and to collect a variety of marketing data. Summer workers were paid an average of $7.15 per hour, and on average worked 40 hours per week. Noteworthy is the reality that throughout the growing season, worker absences due to various planned reasons were common. As a result, many days there were only 5 to 6 summer workers working on the project. Summer workers and interns recorded hours of time they spent working on each enterprise. In addition, two salaried horticultural technicians managed each stage of production, and the hired labor. Their time was also recorded, and as a result the project yielded accurate work hours for each crop in each stage of production.

Several types of farm machinery, equipment and other fixed resources were used in this project. Table 3 provides a description of machinery, equipment, buildings, and retailing resources used by each produce type for the project. Specific records were kept to account for the actual hours each piece of machinery (and labor) was used for each stage of production for each type of produce. Procedures published by the American Society of Agricultural and Biological Engineers were used to compute costs associated with using all machinery, equipment, and buildings.

Retailing Activities and Resources

The Noble Produce Market (NPM) was first open to the public on June 15th and remained open until August 11th. Fresh produce was retailed out of a commercial-sized distribution warehouse located on-site of the Headquarters Research Farm. Ardmore was assumed to represent a rural shopping center for residents living in the rural region of south-central Oklahoma. Located in Carter County, Ardmore and the surrounding rural communities of Dixon, Lone Grove, and Gene Autry have approximately 46 thousand residents (US Census Bureau). In addition, Ardmore is located adjacent to Interstate 35 and is centrally located between the Dallas/Fort Worth metropolitan area in Texas and the Oklahoma City metropolitan region in Oklahoma. The distance between the two urban centers is approximately 100 miles in either direction.

Fresh produce was made available to the public at the time it was harvested for a total of 54 days. All produce items were clean-washed and weighed prior to being made available to consumers. Blemished and quasi-perished produce was routinely culled from the sale tables to insure only the most fresh and highest quality produce was available for consumption. Surplus produce was placed in a cold storage facility to lengthen its shelf life. In addition, substantial resources, such as high quality lighting, clean and colorful product tables and conveniently located price and produce description displays, were made available in order to provide consumers with a friendly and pleasant environment conducive for making clear and conscience purchasing decisions.

A total of 5 advertisements detailing the market hours, location, and produce availability were made available in the Sunday edition of the local newspaper, The Admoreite. In addition, a special internet web site was created detailing market hours, produce availability (updated weekly) and driving directions (including a map) to the market. The web site was made available to the public for free.

The market was open each day of the week (except Sunday) to the public for a total of 35 hours per week. Store hours varied depending on the day. A variety of data was collected each day, including quantity and price for each type of produce sold, gender of customer for each sale, and day and time of sale. Prices charged by local supermarkets were used to determine an initial price floor for produce produced in the project. Supermarket prices were collected twice a week, beginning two weeks before our market opened, and each week thereafter until the closing of the market in August.

The project provided the opportunity to determine the actual revenue and costs associated with production and retailing activities for each produce type. As a result, a detailed set of revenue-cost accounts were developed and used to describe the financial performance of the garden project. Cumulative gross revenue for each type of produce was taken from market data collected at the produce market each day. Cost of production was partitioned into two primary components: variable cash expenses and fixed capital expenses associated with the use of machinery, buildings, and equipment. Net return was calculated as the difference in gross receipts and total cost of production for each crop. Breakeven price for each crop type was calculated by dividing marketable yield for each crop into total cost of production for each crop.

Results and Implications

Table 4 reports the quantity of each crop harvested, quantity defected, quantity made available for sale, quantity sold, and the quantity made available that could not be sold for each crop. Some crops experienced substantial disparity between what was actually harvested and what was actually made available for sale at the market. For example, out of the 11,925 pounds of field tomato that were harvested, 7663 pounds, or 64 percent, was made available to consumers. To illustrate a comparison, large-scale market-quality tomato producers operating in the San Joaquin Valley in California would expect to harvest and sell between 60 and 75 percent of their crop (Le Strange et al.). Similarly, a large proportion of each type of squash, especially the zucchini squash, cucumber, bell pepper, and okra could not be marketed due to poor quality or its size was too large for the market. In a large scale production state such as California, much of the defected produce could be salvaged by frozen food processors or possibly by a food cannery.

In addition to waste in the field, we also found that out of the many crops produced in this project, a large portion of the quantity made available to consumers could not be sold before it perished. In the case of field tomato, as an example, the percentage of marketable produce that went to waste was greater than 50 percent. Also, a large portion of the various varieties of pepper could not be sold and eventually went to waste. Out of all the produce items produced, seedless watermelon incurred the least amount of perishability. We only suffered a ten percent loss of this item. From the information provided in Table 4,

It is also important to note here that the amount actually harvested did not necessarily equal the amount actually grown. The southern pea enterprise is used to illustrate the point. Due to unusually high summer temperature during the 2006 growing season, most of this crop burned in the field, making it pointless to harvest. As a result an estimated 90 percent of the crop was not harvested. Okra provides another example of production loss due to extreme weather. Due to excess rainfall, planting of okra was pushed back approximately three weeks, resulting in a three week delay in production and harvesting. As fresh okra became available, many of our other crops had ceased to produce. Demand for okra was strongest when we had no supply. As a result we failed to harvest an estimated 80 percent of the planted okra. These two crops were also chosen to illustrate the damaging effects that unpredictable and highly variable growing conditions can have on the both the production and retailing of locally grown fruits and vegetable in this part of the country.

Table 5 reports average, minimum, and maximum prices charged at two local supermarkets and for the Noble Produce Market for each crop. A key point to be made here is that depending on the store, consumers that shopped at the NPM did in fact pay a differentiated price for particular crop items. For example, shoppers paid, on average, between $0.46 and $0.55 more per pound for field tomatoes at the NPM than they did at the local supermarkets. When queried, approximately 99 percent of our customers informed us that they were happy to pay the premium and opined their satisfaction by returning frequently to purchase more tomatoes.

Gross receipts, variable and total cost, gross margin and net return, and breakeven price for each crop is reported in Table 6. As indicated, that the total cumulative net return from the garden project was a negative $41,582, and does not include a value for using the land, or warehouse used by the market. Cumulative gross sales equaled $20,457. Total variable costs, including the opportunity cost of cash investment equaled $57,568, and accounted for approximately 93 percent of the total costs of production. In addition, harvest labor accounted for approximately 24 percent of the total variable costs. Gross margin (difference between gross receipts and total variable expenses) is a measure of short run profitability and was equal to a negative $37,112. Cumulative fixed capital expenses were equal to $4,470, and accounted for approximately 7 percent of the total cost of production.

The fixed costs were calculated assuming all machinery, equipment, and building were purchased new in 2006. Understanding that some producers would in fact use a mix of new and used equipment, we followed the approach used by Le Strange of using only 50 percent of the total fixed cost to account for this possibility. The affect of reducing total fixed costs by one half, or $2,235, has only a minimal effect on reducing the final economic outcome of the project.

We also concede that utilizing an expensive overhead linear irrigation system is also questionable. We note that the cost of fuel associated with this system accounted for approximately 16 percent of the total variable expenses. Horticultural specialists could argue that a drip irrigation technology could have been used and would have reduced this expense tremendously. If we make the assumption that drip irrigation would only be one tenth the costs of the overhead linear system, we find that total variable expenses would be reduced by $8,368, a substantial cost savings. However, after accounting for the reduction in fixed costs associated with using a drip system instead of the linear system, and assuming one would use a mix of new and used equipment and machinery, the project would still have incurred a negative net return of approximately $31,000.

Noteworthy is the fact that some costs incurred with operating the produce market (i.e., electricity, web site development, and data collection) have been excluded at this time. As a result, the total costs have been understated; however, these costs are not expected to contribute substantially more to the lack of profitability of the project.

Extending the analysis further, we compared the daily average cost of harvesting, cleaning, and retailing our produce with the average daily value of sales. This is important, because all the production expenses up to the point in time where a decision must be made regarding whether or not to harvest and open the market doors are sunken and considered irrelevant to the decision. We found that the average daily costs of harvesting, cleaning and retailing was equal to approximately $405, and that the average value of sales each day equaled approximately $379, a difference of $26 per day.

Summary and Conclusions

The Noble Produce Garden and Market project was initially developed to provide farm producers with information regarding possible opportunities that might be available to them from the small scale production and retailing of fresh fruits and vegetables in the rural region of south-central Oklahoma. Actual costs of production, cost of sales, and gross receipts for each crop were determined for a mix of 27 crop enterprises produced on a total of 15.5 acres in south-central Oklahoma. Total net return to the project was equal to a negative $41,582. Although the project did not yield a profit, an abundance of useful production and marketing information was collected from the project. This information helped us form several insightful conclusions.

First, it was easy to see that excessive rainfall during preplanting and planting stages and extreme heat during the harvest period affected both yields and sales of certain crops. For example, excessive heat hindered production of southern pea and field tomato, both of which had a high demand. Excessive rainfall stalled production and harvesting of crops such as okra and corn, which created a disparity between the time of high demand and the time of market availability.

Second, we found that the size of the customer base that frequented our market was smaller than desired. The average number of paying customers each day was approximately 42, and the average expenditure per person was approximately $9. Although consumers were willing to pay differentiated prices for what they perceived as fresher, locally grown produce, there were simply not enough of them to cover the costs of production.

A third point of information shows that available labor in the region is primarily high school students, which are available mostly in the summer time. As such, younger student labor may not be as efficient as organized labor that larger more efficient farms in the large-scale producing states have access to. As a result, small-scale farms that depend on hired labor may realize higher labor costs for all stages of production.

A final conclusion was made that more work needs to be done to help producers determine the best way to utilize their resources in order to be successful in small-scale fruit and vegetable production in the region. In addition, more efficient production methods geared at small-scaled operations needs to be developed in order to reduce production costs. Moreover, better information regarding the benefits from eating locally grown fruits and vegetables needs to be communicated to citizens living in the rural communities. If we are to have larger demand in rural communities for locally grown produce, we will need to do a better job educating our citizens living in these areas about the benefits from healthier, more nutritional diets and the benefits to the community from purchasing locally grown fruits and vegetables.

Our plan for the future is to utilize production information gleaned from the project to develop mathematical programming models that utilize alternative production technologies and those resources actually available to producers in the region. We can use information from these models to determine what (if any) produce items they should consider producing, and what quantities of each they should produce. We could also use this type of modeling approach to determine possible marketing strategies, including selling excess supply to urban markets and possibly to schools that are interested in provided more nutritional foods to students residing in the community.

References

Agricultural Marketing Service (AMS-USDA). *AMS Farmers' Market Facts.* 2002.

American Society of Agricultural and Biological Engineers. Agricultural Machinery Management Data. ASAE D497.5, St. Joseph, MI, 2006.

Darby, K, M.T. Batte, S. Ernst and B. Roe. "Willingness to Pay for Locally Produced Foods: A Customer Intercept Study of Direct Market and Grocery Store Shoppers." Selected Paper Prepared for Presentation at the American Agricultural Economics Association Annual Meeting, Long Beach, California, July 23-26, 2006.

Eastwood, D., J. Brooker, and M. Gray. "Consumer Attitudes, Perceptions, and Behaviors About Locally Grown Fresh Produce: A case Study of Six Locations in Tennessee," Univ. of Tennessee AES Res. Report 98-09. September, 1998.

Estes, E.A. "Tomato Wars: A Discussion of How International Trade, Structural Changes, and Competitiveness Affect the North American Produce Industry." *J. of Agri. and App. Econ.* 35,2(August 2003):313-319.

Govindasamy, R., and J. Italia. "A Willingness-to-Purchase Comparison of Integrated Pest Management and Conventional Produce." *Agribusiness* 14,5(1998):403-14.

National Agricultural Statistics Service (NASS-USDA). "Market Value of Agricultural Products Sold Including Direct and Organic: 2002 and 1997." Agricultural Census 2002. Found at: http://www.nass.usda.gov/census/census02/volume1/us/st99_2_002_002.pdf.

National Resource and Conservation Service (NRCS-USDA). Irrigation Water Management Technical Resources. Found at: http://www.wy.nrcs.usda.gov/technical/soilmoisture/soilmoisture.html.

Le Strange, M., J.G. Valencia, B.L. Weir, R.J. Mullen, K.M. Klonsky, R.L. De Moura, and S. Stoddard. "Sample Costs to Produce Fresh Market Tomatoes." University of California Cooperative Extension, Sample Cost of Production Study TM-SJ-00. 2000.

Lamont, W.J., M.D. Orzolek, E.J. Holcomb, K. Demchak, E. Burkhart, L. White, and B. Dye. "Production System for Horticultural Crops Grown in the Penn State High Tunnel." *HortTech.* 13,2(April-June 2003):358-362.

Loureiro, M.L. and S. Hine. "Discovering Niche Markets: A Comparison of Consumer Willingness to Pay for Local GMO-Free Products." *J. of Agri. Appl. Econ*. 34,3(December 2002):477-487.

US Census Bureau. "Census 2000 Data for the State of Oklahoma." Found at: http://www.census.gov/census2000/states/ok.html.

Wells. O.S. "Season Extension Technology." Proc. 15th Intl. Congr. for Plastics in Agriculture and the 29th Natl. Agr. Plastics Congr. Appendix B(2000):1-7.

Wells, O.S. and J.B. Loy. "Reowcovers and high tunnels enhance crop production in the northeastern United States." *HortTech.* 3,1(1993):92-95.

Wells, O.S. "Rowcover and high tunnel growing systems in the United States." *HortTech.* 6,3(1996):172-176.

Wolf, M., A. Spittler, and J. Ahern. "A Profile of Farmers' Market Consumers and the Perceived Advantages of Produce Sold at Farmers' Markets." J. of Food Dist. Res. 36,1(March 2005):192-201.

Yen, S.T., B. Lin, J.M. Harris, and N. Ballenger. "Demand for Differentiated Vegetables." Selected Paper Prepared for Presentation at the American Agricultural Economics Association Annual Meeting, Denver, Colorado, August 1-4, 2004.

Table 1. Farm Location, Soil Type, Acreage, Production Technology, Plant Spacing, and Planting Method by Crop Enterprise

Produce Description	Soil Type[a]	Acreage	Production Technology[b]	Plant Spacing[c]	Planting Method[d]
Anaheim Pepper	1	0.04	RBPM	18x18	Transplant
Banana Pepper	1	0.04	RBPM	18x18	Transplant
Bell Peppers	1	0.08	RBPM	18x18	Transplant
Cantaloupe	4	0.92	CTP	24x80	Seed
Cucumber	3	0.60	RB	12	Seed
Cucumber in Hoop House	3	0.03	HHPB	12	Seed
Eggplant	1	0.02	RBPM	24	Transplant
Gladiolus in Hoop House	3	0.03	HHPB	6x6	Corm
Zucchini Squash	4	0.26	CTP	24x80	Seed
Italian Long Pepper	1	0.04	RBPM	18x18	Transplant
Jalapeno Pepper	1	0.04	RBPM	18x18	Transplant
Okra	4	1.91	CTP	12x80	Seed
Pablano Pepper	1	0.03	RBPM	18x18	Transplant
Habanera Pepper	1	0.03	RBPM	18x18	Transplant
Watermelon	2	0.33	RBPM	36	Transplant
Snap Beans	4	0.59	CTP	3x40	Seed
Southern Pea	4	1.32	CTP	3x40	Seed
Sunflower	3	0.17	RB	12x12	Seed
Sweet Corn	4	5.73	CTP	10x40	Seed
Field Tomato	1	0.64	RBPM	24	Transplant
Field Tomato in Hoop House	3	0.03	HHPB	24	Transplant
Yellow Squash	4	0.80	CTP	24x80	Seed
Yellow Squash in Hoop House	3	0.03	HHPB	24	Seed
Zinnia	3	0.24	RB	12x12	Transplant

[a] Soil Type 1 is a Weatherford fine sandy loam with a 3-5% slope; soil type 2 is a Wilson silt loam with a 1-3% slope; soil type 3 is a loam soil amended with peat moss; and soil type 4 is a Dale silt loam.
[b] CTP is conventional tillage practices, RBPM denotes raised beds with plastic mulch; RB denotes permanent raised beds, and HHPB denotes hoop house with permanent growing beds.
[c] First number is inches between plants, second number is inches between rows.

Table 2. Initial Starting Dates for Preplant, Planting, Harvest, and Cleanup Stages of Production

Produce Description	Preplant	Planting	Harvest	Cleanup
Anaheim Pepper	15-Mar	7-Apr;2-May	6-Jun	8-Aug
Banana Pepper	15-Mar	7-Apr;2-May	5-Jun	8-Aug
Bell Peppers	15-Mar	7-Apr;2-May	6-Jun	8-Aug
Cantaloupe	7-Apr;15-May	22-May	1-Aug	23-Aug
Cucumber	6-Mar	13-Apr	6-Jun	18-Jul
Cucumber (HHPB)	11-May	11-May	12-Jul	11-Aug
Eggplant	15-Mar	4-Apr;28-Apr	22-Jun	9-Aug
Field Tomato	15-Mar	4 and 28-Apr;8 and 30-May	12-Jun	9-Aug
Field Tomato (HHPB)	14-Mar	28-Mar	5-Jun	11-Jul
Gladiolus	31-Mar	31-Mar	20-Jun	14-Aug
Gold Zucchini Squash	7-Apr;15-May	11-Apr;22-May	31-May	23-Aug
Green Zucchini Squash	7-Apr;15-May	11-Apr;22-May	31-May	23-Aug
Habanera Pepper	15-Mar	7-Apr;2-May	27-Jun	8-Aug
Italian Long Pepper	15-Mar	7-Apr;2-May	5-Jun	8-Aug
Jalapeno Pepper	15-Mar	7-Apr;2-May	5-Jun	8-Aug
Okra	7-Apr;15-May	19-May	27-Jul	23-Aug
Pablano Pepper	15-Mar	7-Apr;2-May	14-Jun	8-Aug
Watermelon	27-Mar	20-Apr	21-Jun	23-Aug
Snap Beans	7-Apr;15-May	11, 17 and 25-Apr;18-May	6-Jun	23-Aug
Southern Pea	7-Apr;15-May	15-May	18-Jul	23-Aug
Sunflower	6-Mar	18, 19, and 25-May	3-Jun	23-Aug
Sweet Corn	31-Mar,15-May	14 and 17-Apr;18-May	14-Jun	23-Aug
Yellow Squash	7-Apr;15-May	11-Apr;22-May	31-May	23-Aug
Yellow Squash (HHPB)	11-May	11-May	19-Jun	7-Aug
Zinnia	6-Mar	10-Apr	30-May	23-Aug

Table 3. Machinery, Equipment, and Buildings Used in Crop Production and Retailing Activities by Crop Type

Description	Pepper	Water-melon	Squash	Egg-Plant	So. Pea	Snap Bean	Cuc-cumber	Sweet Corn	Canta-Loupe	Okra	Zinnia	Sun-Flower	Field. Tom.	HH Tom.	HH Cuc.	HH Glad.	HH Squash
Production Activities:																	
50 HP Tractor	X	X		X									X				
90 HP Tractor			X		X	X		X	X	X							
35 HP Tractor	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
135 HP Tractor			X		X	X		X	X	X							
5' Rotary Tiller	X	X		X									X				
8' Tandem Disc	X	X	X	X	X	X		X	X	X			X				
14' Disc			X		X	X		X	X	X							
Prebedder	X	X		X									X				
Bed shaper	X	X		X									X				
Plastic Mulch Layer	X	X		X									X				
Plastic Mulch Remover	X	X		X									X				
4 Row Lister/Bedder			X		X	X		X	X	X							
4 Row Cultivator								X									
Walk behind tiller	X			X			X				X	X	X	X	X		X
Wylie 200g Sprayer			X		X	X		X	X	X							
Air Blast Sprayer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Backpack Sprayer							X				X	X		X	X	X	X
RTV	X	X		X			X				X	X	X	X	X	X	X
Pickup Truck 1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pickup Truck 2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Gooseneck Trailer			X		X	X		X	X	X							
Small Utility Trailer	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Commercial Scale	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X
Linear Irrigation System			X		X	X		X	X	X							
Lely Broadcast Spreader	X	X		X									X				
Vacuum Seeder			X		X	X		X	X	X							
Miscellaneous Hand Tools	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Hoop House (30'x40')														X	X	X	X
Retailing Activities:																	
Refrigerated Display Case									X		X	X				X	
Cold Storage Facility	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Cash Register	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Small Transaction Scale	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Produce Display Tables	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Table 4. Quantity Harvested, Defected, Marketed, Sold and Perished by Crop Type ($)

Produce Description	Quantity Harvested	Quantity Defected or Semi-Perished	% Defected or Semi-Perished	Quantity Marketed	Quantity Sold	Quantity Perished	% Perished
Anaheim Pepper (lbs)	556	191	34%	365	52	313	86%
Banana Pepper (lbs)	498	79	16%	419	106	313	75%
Bell Peppers (lbs)	1330	507	38%	824	285	538	65%
Cantaloupe (each)	442	0	0%	442	148	295	67%
Cucumber (lbs)	4156	1975	48%	2181	981	1200	55%
Eggplant (lbs)	248	35	14%	213	125	87	41%
Field Tomato (lbs)	11925	4262	36%	7663	3684	3979	52%
Gladiolus (dozen)	31	2	6%	29	2	27	92%
Gold Zucchini Squash (lbs)	1637	1159	71%	478	213	265	55%
Green Zucchini Squash (lbs)	4909	3476	71%	1433	454	978	68%
Habanera Pepper (lbs)	50	2	4%	48	4	44	91%
Italian Long Pepper (lbs)	595	131	22%	464	66	398	86%
Jalapeno Pepper (lbs)	808	12	1%	796	90	706	89%
Okra (lbs)	1201	705	59%	496	282	214	43%
Pablano Pepper (lbs)	186	55	30%	131	37	94	72%
Seeded Watermelon (each)	339	0	0%	339	185	154	45%
Seedless Watermelon (each)	580	0	0%	580	524	56	10%
Snap Beans (lbs)	555	0	0%	555	240	315	57%
Southern Pea (lbs)	397	0	0%	397	233	164	41%
Sunflower (dozen)	52	0	0%	52	21	32	61%
Sweet Corn (ears)	17102	5606	33%	11496	9028	2468	21%
Yellow Squash (lbs)	8196	4832	59%	3364	1215	2149	64%
Zinnia (dozen)	321	0	0%	321	85	236	74%

Table 5. Average, Minimum, and Maximum Prices Charged at Local Store and the Noble Produce Market by Crop

	Store 1			Store 2			NPM			Difference	Difference
Produce Description	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Store 1	Store 2
Anaheim ($/lbs)	2.57	1.53	2.64	1.94	1.19	1.99	2.68	1.00	3.00	0.12	0.74
Banana ($/lbs)	NA	NA	NA	NA	NA	NA	2.81	1.00	3.05	NA	NA
Bell ($/lbs)	1.48	0.78	1.95	1.16	0.56	1.78	1.99	1.00	2.15	0.51	0.83
Cantaloupe ($/each)	1.53	0.73	1.88	2.04	0.51	3.50	2.50	2.50	2.50	0.97	0.47
Cucumber ($/lbs)	0.78	0.58	1.05	0.82	0.33	1.15	1.02	0.80	2.00	0.24	0.20
Cut Flowers ($/dozen)	4.88	3.88	9.92	3.25	1.50	4.98	3.36	3.25	4.25	-1.53	0.11
Eggplant ($/lbs)	1.54	1.54	1.54	1.54	1.27	1.99	1.61	1.00	1.75	0.07	0.07
Habanera Pepper ($/lbs)	NA	NA	NA	NA	NA	NA	4.29	2.50	5.00	NA	NA
Italian Long Pepper ($/lbs)	NA	NA	NA	NA	NA	NA	1.49	1.00	1.55	NA	NA
Jalapeno Pepper ($/lbs)	0.68	0.68	0.68	1.19	1.19	1.19	1.26	1.00	1.30	0.58	0.07
Okra ($/lbs)	NA	NA	NA	4.36	3.72	5.00	3.50	3.00	4.00	NA	-0.86
Pablano Pepper ($/lbs)	1.47	1.47	1.47	5.99	5.99	5.99	1.62	1.00	1.70	0.15	-4.37
Seeded Watermelon ($/each)	2.98	0.20	4.50	7.09	3.98	7.99	6.23	6.00	8.00	3.25	-0.86
Seedless Watermelon ($/each)	2.89	0.19	4.50	4.12	0.32	6.99	2.73	2.50	4.00	-0.15	-1.39
Snap Bean ($/lbs)	1.58	1.58	1.58	1.20	0.69	1.39	1.78	1.75	2.00	0.20	0.58
Southern Pea ($/lbs)	NA	NA	NA	NA	NA	NA	2.50	2.50	2.50	NA	NA
Sweet Corn ($/each)	0.26	0.25	0.33	0.36	0.17	0.59	0.27	0.10	0.30	0.02	-0.09
Field Tomato ($/lbs)	1.44	0.83	1.58	1.52	0.98	1.79	1.99	1.75	2.00	0.55	0.46
Yellow Squash ($/lbs)	1.53	1.53	1.53	1.23	0.99	1.39	1.61	1.00	1.75	0.08	0.38
Zucchini-Gold ($/lbs)	1.53	1.53	1.53	1.24	0.99	1.39	1.59	1.00	1.70	0.06	0.35
Zucchini-Green ($/lbs)	1.53	1.53	1.53	1.23	0.99	1.39	1.59	1.00	1.70	0.06	0.37

Note that average price for each produce item for Store 1 and Store 2 is calculated using price information collected 17 times over the period beginning June 5th through August 5th, 2006. Store visits were made each Monday and Friday morning over the time period. In addition, price difference between what was charged at the Noble Produce Market and Store 1 or Store 2 reflects average premium or discount paid by consumers for locally grown produce items.

Table 6. Receipts, Costs, Net Return and Breakeven Price by Crop Type ($)

Produce Description	Gross Receipts	Variable Costs	Gross Margin	Fixed Costs	Total Cost	Net Return	Breakeven Price
Anaheim Pepper	146	915	-768	132	1047	-900	2.87
Banana Pepper	293	900	-607	132	1032	-739	2.46
Bell Pepper	589	1072	-484	132	1205	-616	1.46
Cantaloupe	376	2295	-1919	274	2569	-2193	5.81
Cucumber	880	4,360	-3,479	291	4,651	-3,770	5.21
Eggplant	203	538	-335	123	662	-458	3.11
Gladiolus	93	1869	-1775	153	2021	-1928	69.69
Habanera Pepper	8	472	-463	132	604	-595	12.58
Italian Longs Pepper	99	887	-788	132	1019	-920	2.20
Jalapeno Pepper	114	909	-795	132	1042	-927	1.31
Okra	977	2941	-1964	265	3205	-2229	6.46
Pablano Pepper	62	797	-735	132	930	-867	7.11
Seeded Watermelon	1080	1440	-360	114	1554	-474	4.58
Seedless Watermelon	1324	1436	-112	114	1550	-226	2.67
Snap Bean	422	1563	-1141	278	1841	-1419	3.32
Southern Pea	583	2062	-1479	278	2340	-1757	5.89
Sunflower	65	1010	-946	89	1099	-1034	21.14
Sweet Corn	2660	9095	-6435	278	9373	-6713	0.82
Tomato--Field	7182	8423	-1241	318	8741	-1559	7.04
Yellow Squash	1941	7096	-5155	468	7565	-5624	9.08
Zinnia	275	1418	-1143	89	1507	-1232	4.69
Zucchini	1074	5599	-4525	280	5879	-4805	3.08
Total	20457	57568	-37112	4470	62038	-41582	--------